Math Department
Unit-Level Assessment Liaison Report
Spring 2022

Liaison Project Start Date: Spring 2021

Liaison Report prepared by Chao Lu

I. Department Buy-In and Outcome Definition

Math 141-Plane Trigonometry is one of two courses (Math 140-College Algebra; Math 141-Plane Trigonometry) that are the prerequisites for Math 207 Calculus I. At the end of Fall 2020, the Mathematics Department started a new assessment process for this course. Math faculty considered "Solve trigonometric equations" a particularly important SLO students need to master for further courses in Mathematics curriculum, especially in Calculus sequences. During Spring 2021 semester, we created and administered a pilot assessment addressing this SLO. The Math 141 assessment consists of four components: solve a trigonometric equation in specific domain interval and in general, choose a correct solving process, and solve a trigonometric equation by continuing the solving process. The assessment includes three multiple choice and one open-ended math problems. At the beginning of Fall 2021, the results and findings were shared through email to the Math department. Faculty were excited and collaborated to modify/improve the assessment tool based on the feedback from the pilot. During November 2021, we deployed the revised assessment tool to all the planned courses/sections.

II. Assessment Research and Design

The research and design of the assessment occurred in Spring 2021 semester, based on the footprint of a prior assessment (for Math 140). See last year's report for details.

III. Pilot Assessment Tools and Processes

The pilot was conducted in Spring 2021 and successful enough that the department agreed to go ahead with a full deployment in Fall 2021. See last year's report for details.

IV. Administer Specific Assessment

At beginning of the Fall 2021semester, we invited more mathematics full-time faculty members to collaborate in finalizing our assessment. We revised the assessment tool based on the feedback from the students who participated in the pilot as well as our faculty team. We revised the wording for the first two questions, solve trigonometric equation in specified domain and solve trigonometric equation for general solution. We also modified the open-ended question into two-step questions to collection more information about students' thinking processes.

For Fall 2021 semester, Math department not only offer fully online courses, remote/live online courses but also in-person/on-campus courses. We hoped to gather information across the learning modality which could help us to compare the data. We added a background question to the survey: "Please indicate which modality your class is? A 'modality' refers to the manner of instruction: in-person, for example, or live online."

During week 11 of the Fall 2021 semester, we invited students from five courses (Math 141 Plane Trigonometry, Math 207 Calculus I, Math 208 Calculus II, Math 209 Calculus III, and Math 210 Differential Equations), a total of 18 sections (Math 141- 5 sections, Math 207 – 6 sections, Math 208 – 4 sections, and Math 209 – 2 sections, Math 210-1 section). There were 11 faculty (7 full-time faculty and 4 part-time faculty) involved with 298 students as potential participants.

The survey was initially planned to run for 4 weeks, between November 8th 2021 and December 4th 2021, but it was extended to later December (closed on December 20th 2021) due to the low participation rate at the end of the initial period. We tried to collect more unique student responses. Every week, a reminder email was sent out to all 11 faculty members to encourage the participation. We also offered raffle prizes for participating students as well as faculty members as encouragement and appreciation.

V. Data Analysis

Our data set consisted of 36 unique/valid responses. During the Spring 2022 semester, we started the data analysis process and sought help from the Assessment Committee's data analyst, Phil Vargas. After reviewing the results, the data analyst informed us that the number of valid responses was too few for valid inferences and offered two options. One option was to treat this attempt as a second pilot and see consider ways that we can improve the assessment when we try again. The other option was to attempt to glean some information about student learning, even though the results don't meet statistical significance.

As a department, we decided that we would like to investigate data and gather some information about the learning of those who completed the assessment.

For question #1, solving a trigonometric equation in a specific domain interval, more than half of the students (n = 23 individuals, 64%) chose both correct solutions. This is lower than we hope but the result was improved compared to the pilot (n =12 (of 29), 41%). For question #2, solve a trigonometric equation in general, less than half of the students (15 individuals, 42%) chose the correct solution. It is decreased from pilot (17 individuals, 59%). For questions #3, chose a correct solving process, more than 70% of students (26 individuals, 72%) chose the correct solving process. The result showed an improvement from the pilot (19 individuals, 66%). All students (36 individuals, 100%) answered the first part of the question #4, the open-ended questions, solve a trigonometric equation by choosing one of the two routes and continuing the solving process to achieve the answer. The result also showed most students (26 individuals, 72%) tried to answer the second part of the question #4. The participation rate on this part was decreased from the pilot which was 83% (24 individuals out of 28) but, again, was higher than we expected. Among the 26 responses, 3 responses included all five correct solutions, and 20 responses included partially correct solutions, and 3 responses had no correct solutions.

Overall, the participants from Math 141 had the most participants (21 individuals, 58%) and performed better than other courses for Question #1 (67% accuracy) and Question #3 (71% accuracy). Math 209 participants performed better than other courses for Question #2 (67% accuracy).

Some other findings from the data set:

- *The modality of the classes of the participants:* 2 (6%) participants were from in-person sessions, 19 (53%) participants were from online live/zoom sessions, 15 (42%) participants were from fully online sessions, and no participant was from hybrid session.

- *The population of the participants:* This assessment was sent to groups of students from Math 141, Math 207, Math 208, Math 209. Math 210 Among those 36 valid responses, 21 (58%) of them are from Math 141, 8 (22%) are from Math 208, 3 (8%) are from Math 209, 4 (11%) are from Math 210, and there are no participants from Math 207.

- *The device students were using to take this survey:* Four choices were listed including Computer (Desktop or Laptop), Tablet (iPad or Android tablet etc.), Cell Phone and Other. 31 (86%) of the students used Computer (Desktop or Laptop), 1 (3%) of students used Tablet (iPad or Android tablet etc.) and 4 (11%) of the students used Cell Phone.

- *Feedback questions were asked to all participants:* Questions asked were, "Did you have any challenge or technique issue during the survey? Do you have any other suggestion(s) to help us improve the survey for the future students?" 28 (78%) of students answered this open-ended question. No one reported a technique issue/challenge, but more than half of them mentioned that they felt the question(s) is difficult/challenge due to not remembering the needed knowledge and material. 3 (8%) of the students suggested including more related examples or videos. 6 (17%) of students thought it was a great survey.

Again, though, these findings cannot be generalized to make inferences about the students in this set of classes since the sample was so small.

VI. Supporting Evidence-Based Change (Use of Findings)

We learned a lot from this assessment project. Many of the faculty collaborated and worked together to develop the assessment tool and we had great pilot during the Spring 2021 semester. At the beginning of the Fall 2021 semester, we modified/revised the assessment tool based on the feedback from the pilot participants and faculty from the department. For the full roll out assessment during Fall 2021, we had potential participants of 298 students. We were targeting for 150 unique/valid response but unfortunately, we only collected 26 unique/valid participants' responses. Even though the results don't meet statistical significance, we still found some areas we could do more or may do differently to improve future assessment projects.

- *Advertisement/marketing*
  During week 11 of the Fall 2021 semester, the department assessment liaison sent an email containing the detailed instructions of the assessment tool/survey to the involved faculty. The assessment liaison also generated a sample email to students sent to the involved faculty to help the workload. A weekly reminder email was sent out in the following weeks.

We encouraged faculty to award extra credit to students who take the survey. We also offered raffle prizes for participating students and involved faculty (as separate raffles).

What can we try next time?
In addition to the email blast, extra credit, and participant/faculty raffle prizes, we plan to go to targeted in-person class sessions or join targeted Zoom meeting sessions to recruit the participants. We could also host a short informational session for involved faculty to explain the assessment and related logistic process.

- *Delivery mode*
  This time, we created the survey in Google form format, and it was sent as a link to faculty. The faculty posted the link on their Brightspace course shell or mailed the link directly to students. Students may have lost the email or had difficulty finding the link under the course announcement if they did not complete the survey soon after received the link/email.

  What can we try next time?
  We could consider creating a Brightspace module that faculty can include/insert the module into their course shell directly.

- *Open-ended question grading*
  The second part of the last open-ended question has five correct answers. This time with only 36 unique/valid responses, we were able to grade them one-by-one. We may be challenged to grade this part of question if we collect a large amount of the responses in a future iteration. We need to find an efficient and sustainable method to grade this part if we have over 100 or more valid responses.

Success Factors

Faculty from our department were motivated and worked collaboratively during the planning and deployment of the project, developing the assessment tool, and encouraging students to participate the survey during the pilot as well as the full roll out stage. It was a great experience work as a team. Math department continues to commit to assess students' learning related to the Trigonometric equations across the Math 141 Plane Trigonometry and Math 207-209 Calculus class sequences.

Recommendations

I would recommend that our math department to attempt the assessment again in the Fall 2022 semester, with at least one or more of the possible changes (*Advertisement/marketing, delivery mode etc.)*. I would propose this recommendation during the department meeting which will be held before the end of Spring 2022 semester, I would gather any suggestions/recommendations from the Math faculty to plan the departmental assessment task for the Fall 2022 semester.